United States Department of the Interior

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BUREAU OF LAND MANAGEMENT
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Memorandum

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Div. of Oil, Gas & Mining

To: G. William Lamb, State Director
Utah Bureau of Land Management

From: Lynn Jackson, Project Manager, Lisbon Valley FEIS
Brad Palmer, Field Office Manager
Bureau of Land Management, Moab Field Office

Subject: 145 IBLA 348, National Wildlife Federation, et. al.

Date: January 25, 1999

In National Wildlife Federation, et. al., 145 IBLA 348 (1998), the Interior Board of Land Appeals (IBLA) directed the Bureau of Land Management (BLM) to reconsider the backfilling alternatives analyzed in the Lisbon Valley Copper Project Final Environmental Impact Statement (FEIS). In the ruling, IBLA indicated that the FEIS and accompanying Record of Decision (ROD) did not support the rejection of the Open Pit Backfilling Alternative in light of inconsistent information in the record. This memorandum is intended to provide BLM's reconsideration of the backfill issue as directed, and to provide your office with necessary information to respond to IBLA's remand regarding this issue.

The proposed mine analyzed by the FEIS and ROD presented a number of complicated technical issues, primarily associated with the hydrogeologic and geochemical characteristics at the site, and the subsequent impacts from and to those characteristics over the life of mining and after mining. A great deal of the technical analysis generated and reviewed during the process was summarized in the FEIS and ROD as directed by 40 CFR 1500.4. Additional supplementary data was collected and analyzed after the FEIS and ROD were released, primarily to meet requirements of the conditions of approval for the mine, but also to respond to concerns raised by the IBLA when it partially stayed the BLM's decision pending appeal. (See IBLA's order dated June 16, 1997).

The analysis of the technical issues, and our process and actions in identifying and clarifying these issues, is provided in the attached report. We believe the information provided in the attachment adequately addresses the IBLA's concerns identified in its remand direction to further consider backfilling. Based on review of the technical information in the case file, the FEIS and the ROD, we believe our analysis of the data led us to a reasoned prediction of potential impacts and the most appropriate course of action. All of the data and analyses, conducted before and after the FEIS and ROD were released, supports the assessment made in the FEIS and ROD that utilizing waste rock from the mining operation to backfill the pits at the cessation of mining poses a significant risk of adverse impact on groundwater in the area.

Based on the re-analysis of data and the conclusion that BLM's rationale for rejecting the backfill alternative was sound and reasoned, our office recommends no modifications or changes to the ROD. Furthermore, since none of the data or additional analyses performed to date identify environmental impacts not previously identified in the FEIS, no additional analysis is warranted under provisions of the National Environmental Policy Act.

We recommend that BLM prepare a Notice of Final Decision to be printed in the Federal Register that outlines and summarizes our actions and final determination. We feel this course of action will meet the requirements of the IBLA decision. We recommend that the Notice of Final Decision be made effective upon publication, since by IBLA's decision of September 23, 1998, the Plan of Operation for Summo USA was approved and affirmed, and BLM decisions approving mining Plans of Operation are full force and effect decisions pursuant to 43 CFR 3809.4(f).

A. Lynn Jackson, Project Manager — Date 1-25-99

Brad Palmer, Moab Field Office Manager — Date 1/25/99

I Concur:

G. William Lamb, Utah State Director
Bureau of Land Management — Date 1-28-99

Attachment: BLM Reconsideration of Summo USA/Lisbon Valley Copper Project Backfilling Alternative (8pp.)

ATTACHMENT
BLM Reconsideration of
Summo USA/Lisbon Valley Copper Project Backfilling Alternative
Based On
National Wildlife Federation, et. al., 145 IBLA 348, September 23, 1998

I. GEOTECHNICAL ANALYSIS

As an initial matter, it is useful to clarify differences between issues and impacts associated with acid generating waste rock, and issues and impacts associated with potential oxyanion mobilization resulting from projected alkaline hydrogeologic conditions in backfilled post-mine pits. The two issues are not related, but are easily confused. The static ABA (Acid Base Accounting) tests referred to in 145 IBLA at 373-374 were primarily utilized to address potential for acid generation from the waste piles at the cessation of mining operations, although the tests did provide for some indirect indications of leachates from post-mining pit walls. Impacts identified as a result of the ABA tests resulted in mitigation for potential acid mine drainage through construction of engineered waste dumps that encapsulated the potential acid generating material. The potential for alkaline mobilization of oxyanions from backfilled waste material and post-mining pit lake water is another issue altogether, the analysis of which required the utilization of waste rock leaching tests.

The FEIS and ROD identified five reasons for rejecting the backfill alternative. One of the identified reasons was the potential for adverse groundwater impacts resulting from leaching interactions between post-mine pit lake waters and the waste rock utilized for potential backfill material. The ROD at p. 10 item 1, identifies this concern by stating:

> 1- The analysis indicates under both backfill scenarios, that there would be water quality impacts from backfilling the pits with material from the waste dumps, due to the chemical makeup of the waste rock backfill material, particularly the acid generating material. With the tremendous increase in surface area exposed in the rubbilized backfill material, chemical reactions between this material and the groundwater could present a host of unquantifiable adverse impacts to the downgradient aquifers, resulting from chemical interactions of groundwater and the waste rock.

Leaching tests of the potentially acid generating material (attributable to up to 10% of the waste rock volume) provided some indication of geochemical problems if the acid generating waste were not properly neutralized within the waste dumps. This was identified as a "particular" concern in the FEIS and ROD. Additionally, however, BLM had concern regarding potential leaching problems with other waste rock types if those rocks were exposed to potentially alkaline conditions in the post-mining pit lakes. While these concerns were perhaps not as well documented and articulated in the FEIS and ROD as the acid leaching potential, they were of just as much concern and significance.

The concerns for leaching interactions, based on potential alkaline conditions in post-mine pits lakes backfilled with waste rock from the mining operation, resulted from the analysis described in the FEIS. This analysis was summarized from technical documents, available test data, and expert opinion and experience of the third party EIS contractors, Woodward-Clyde Consultants.

These concerns are identified in FEIS Section 3.3.4 - Synthetic Precipitation Leach Procedure Tests (EPA Method 1312). The FEIS at p. 3-49 indicates that:

> These tests were conducted to assess the potential mobilization of constituents from exposed waste rock and pit wall rock which may occur from precipitation events and weathering. These tests are important as they can be used to help identify which constituents (a) may be leached from the waste rock dumps; or (b) may be present in precipitation run-off into the open pits."... "The results of the analysis are then used to evaluate the mobility of constituents and potential impacts to surface and groundwater resources.
>
> - In all SPLP tests, the collected leachate had a pH greater than 7.5, and in some cases greater than 9.0.
>
> It should be noted that the Method 1312 procedure may be limited in predictive capability since the test is performed using pH 5.0 deionized water. Those constituents that are mobilized in alkaline (i.e., high pH) environments, such as metal anionic complexes, may not be mobilized in the lixiviant from the Method 1312 analysis.

The analysis in this section goes on to state on p. 3-50 that:

> Professional experience (i.e., open pit gold sites in Nevada and Uranium Mill Tailings Radiation Control Act (UMTRCA) geochemistry) suggest that if pit lakes develop at the site after mining, the water in the lakes could in time become quite alkaline (pH 8.0 or greater), with relatively high TDS, and elevated concentrations of some metal oxyanions (i.e., aluminum, arsenic, selenium, molybdenum, manganese, iron, uranium, zinc) relative to baseline. Therefore, the results of Method 1312 analyses do not preclude the potential capacity for the waste rock material to mobilize dissolved constituents under alkaline conditions.
>
> Table 3.3-1 compiled from published sources presents chemical constituents found in alkaline lakes in the western United States. As indicated in Table 3.3-1, a number of metal oxyanions are present in alkaline lakes with pH ranging from 8.9 to 9.6. Additionally, as discussed previously in Section 3.2.3.3 (Groundwater Quality) groundwater in the Burro Canyon aquifer (e.g., monitoring well MW-2A, Table 3.2-3) contains minor concentrations of many of the constituents listed in Table 3.3-1 suggesting that the oxyanions would be present in post mining pit lake water if pit lakes were to develop.
>
> Existing groundwater quality results from the Burro Canyon aquifer show that oxyanions are currently present in groundwater at the site. Potential evapo-concentration of groundwater inflowing to the post-mining pits over time could ultimately lead to the development of alkaline pit lakes with constituents not unlike those shown in Table 3.3-1 for alkaline lakes of the western United States.

The FEIS impact analysis Section 4.3 - Geochemistry, then provides the following analysis under the heading 4.3.4.1 Open Pit Backfilling Alternative, Impacts, at p. 4-35:

> Both partial and complete backfilling scenarios have the potential to further degrade existing groundwater quality in the vicinity of the proposed pits (anticipating both dissolved iron and aluminum from the 1312 tests, and likely other metal oxyanions as well, as shown in the groundwater sampling). The backfilled waste rock, whatever its geochemical characteristics (i.e., potentially acid generating or alkaline) would have increased surface area; hence it would be easier to leach soluble constituents from these materials, especially as water levels fluctuated. (Emphasis added).

This section goes on to identify, at Section 4.3.4.2 Recommended Mitigation, p. 4-36 that:

> Prior to utilizing on-site waste material for backfilling, Summo should be required to run an acceptable testing procedure (kinetic testing) to allow accurate determinations of geochemical leachates that could be expected from the material if placed in a sub-aqueous alkaline environment. If testing indicates unacceptable leachates, which could migrate into downgradient groundwater, additional inert materials may have to be utilized from outside the project area.

Between the original appeal, dated May 2, 1997, and BLM's response through legal counsel, dated March 9, 1998, BLM required Summo to conduct additional data collection, testing and analysis to meet conditions of this recommended mitigation. This work was done in accordance with terms and conditions of BLM's approved ROD, and the IBLA's partial stay order of June 16, 1997. This additional data was geared primarily toward the drilling, sampling and analysis of additional groundwater data, but also included additional testing of leaching characteristics of the waste rock, in order to more fully evaluate concerns related to potential impacts to groundwater from backfilling the pits with on-site waste rock.

BLM's specific requirements for the additional leach tests were based on provisions of the ROD at pp. 22-24, in addition to technical information in the case file found in memorandums from Bill White to Lynn Jackson, dated August 26, 1997, October 27, 1997, October 30, 1997, and October 31, 1997. These memoranda identify Mr. White's analysis of existing literature, combined with his conclusions based on review of data derived from initial SPLP leaching tests identified in the FEIS, and groundwater geochemistry at the site. The memoranda also analyze and provide specific testing methodologies and procedures to be utilized for leachate testing, based on the practical and technical difficulties of obtaining waste rock for sampling prior to actual mining operations.

Mr. White's memorandum of August 26, 1997, indicates an overall concern with the constituents of Cretaceous-aged bentonitic shales (the principal type of waste rock available for potential backfill material at the site), and the ability of those constituents to become mobilized under the alkaline conditions expected in the post-mining pit lake waters as identified in the FEIS. At p. 1 of APPENDIX A of the August 26, 1997, Memorandum, Mr. White states that:

> According to Lawton (1955, p. 72) and Smith and others (1977, p. 27), soils developed from certain Cretaceous-aged shales in the western United States tend to contain concentrations of selenium (Se) and molybdenum (Mo) that exceed background values typically listed for shales and soils.

At p. 2 of the August 26, 1997 memorandum, he further indicates that:

> Based on literature-search information (Appendix A), As, Mo, Se and U form complexes that can be mobilized under alkaline conditions." (As-arsenic, Mo-molybdenum, Se-selenium, and U-uranium).

He went on to recommend at p. 3 of the August 26, 1997 memorandum that:

> Because arsenic and selenium have been reported in site groundwater samples, BLM should require that their respective solid-phase forms (i.e., selenate/selenite and arsenate/arsenite) are identified for each backfilled waste-rock type.

His concerns with selenium, molybdenum and arsenic are further highlighted at p. 4 of APPENDIX A (August 26, 1997 memorandum) as follows:

> **Selenium** - Soluble selenates would be expected in alkaline soils or alkaline weathering rocks in dry areas. According to NAS (1976, p. 2), because of selenate stability at alkaline pH, its solubility, and its ready availability to plants, selenate appears to be the most dangerous form of selenium as far as potential environmental pollution is concerned.
>
> **Molybdenum** - According to Smith and others, (1996, p. 27) irrigation of alkaline soils developed from Cretaceous-age shales may increase mobility and transport of Mo, resulting in higher amounts of Mo in agricultural soils, crops, and wetland sediments and biota. The availability of Mo to plants is largely dependent on soil pH. Mo availability in soils is greatest under alkaline conditions and least under acidic conditions. This behavior of Mo in the surficial environment is related mainly to its tendency to form dissolved anionic species (Smith and others, 1996, pp. 32-32).
>
> **Arsenic** - NAS (1977, p. 62) suggests that As mobility increases as pH increases, especially if pH is adjusted by liming. The calcium ion present as the principal constituent of lime combines with $(As^{(V)}O_4)^{2-}$ to form a calcium arsenate that is more soluble than the iron or aluminum counterparts of the arsenate complex. Additionally, NAS (1977, pp. 52-52) summarized the efficiency of basic extractants to remove extractable arsenic from soil showed that extractant effectiveness increases with increasing pH:...

Based on these identified concerns, APPENDIX A, pp. 4-5, (August 26, 1997 memorandum), summarizes those concerns for backfilling with mine waste rock as follows:

BASIS FOR CONCERN REGARDING BACKFILL

> The Lisbon Valley site exhibits the following general characteristics; these characteristics are similar to those described in the preceding discussion of conditions and mechanisms required to mobilize oxyanions of such elements as arsenic, molybdenum, and selenium.

- Bentonitic shales are present at the site (Mancos Shale and shale facies in Burro Canyon Fm - Katich, 1958, p. 194).
- Levels of As, Mo, and Se that either approach drinking water standards or exceed detection limits by an order of magnitude are present in groundwater samples from on-site monitoring wells (see Appendix C).
- Samples of site groundwater and surface water have pH values that range from 7 to 9 (FEIS, tables 3.2-1 and 3.2-3).
- Bicarbonate alkalinity is present in surface and groundwater samples (FEIS, tables 3.2-1 and 3.2-3).
- The site is within the largest uranium mining district in Utah (FEIS, p. 3-19).

Additional concerns are identified on p. 5 of APPENDIX A (August 26, 1997 memorandum), as follows:

> Additionally, overburden and waste rock placed in a backfill will usually be characterized by reduction in particle size and subsequent increase in surface area due to blasting and excavating. If the backfill material is placed within the influence of the groundwater table, 1) the increased surface area of the excavated material commonly results in increased mineral-water interface contact, and 2) may result in consequent mineral dissolution and transport by groundwater movement through the backfill. Depending upon the chemistry and permeability of waste-rock types comprising the backfill, possible infiltration of groundwater into these materials has potential to produce the unintended consequence of mobilizing such elements as arsenic, molybdenum and selenium as oxyanions. (Emphasis added).

In the October 27, 1997, October 30, 1997, and October 31, 1997, memoranda from Bill White to Lynn Jackson, Mr. White identifies the specific requirements of the testing procedures to be followed as a result of the difficulty in obtaining waste rock samples. The primary problem in conducting additional leaching tests prior to mining was that waste rock samples had to be collected by drill holes. The drill bit pulverized the material as it was collected, making it difficult for testing. More accurate analysis would require the testing of the actual waste rock as it was mined, so that material representative of the actual waste rock as it was placed in the mine dumps could be tested.

The additional Meteoric Water Mobility Procedures (MWMP) leaching tests were performed under third party contract by Adian Brown Consultants. The results of these additional leaching tests were transmitted to BLM in a technical memorandum dated December 3, 1997, from Mark Williamson, PhD. Geochemist with Adrian Brown Consultants, to Lynn Jackson, BLM Project Manager. This memorandum outlined the results of MWMP leach tests conducted on 24 waste-rock samples collected by drill holes and tested according to procedures established by Mr. White.

The Williamson memorandum indicates at p. 2 the significance and use of the data as follows:

A. This procedure is intended as a means for obtaining extracts from mine rock samples. The extracts may be used to evaluate the final pH and release of certain constituents of mine rocks exposed to meteoric events.

B. The pH of the extraction fluid used in this procedure is to reflect the pH of the groundwater in the site area.

C. This procedure is designed to mobilize potential contaminants present in the solids, so that the resulting extract can be used to assess leachate which could potentially be produced from mine rock in the filed.

D. This procedure produces extracts that are amenable to the determination of both major and minor (trace) constituents. When minor constituents are being determined, it is especially important that precautions be taken in sample storage and handling to avoid possible contamination of the samples.

The results of these tests are presented in detail as tabulated analytical data on 31 pages attached to the report. Analysis of this data indicated that selenium, arsenic and molybdenum were in fact mobilized by exposures to meteoric water (such as would occur in the post-mine pits), and more importantly, the degree of mobilization generally increased with increasing pH levels. The results of these tests on leaching characteristics of the potential backfill material effectively confirmed BLM's concerns identified in the FEIS and ROD of utilizing waste rock from the mining operation as backfill material in the pits.

II. FEIS/ROD ANALYSIS OF GEOTECHNICAL DATA

Due to the fact that there were four additional reasons cited for not requiring the post-mining pits to be backfilled (ROD p. 10), BLM did not believe there was a need to provide detailed review of the technical data in the FEIS regarding the potential geochemical impact of such oxyanion mobilization from the backfill material to the groundwater. The FEIS only presented BLM's summarized review and projection that backfilling may have a significant adverse impact to the groundwater in the area, based on analysis of available test data, pertinent literature and experience. Data presented in the FEIS (Table 3.2-3) clearly showed the presence of mobilized arsenic, molybdenum and selenium in the groundwater at the site. [1]

Based on the concerns identified with this issue in the FEIS, the ROD did two things. First it required, as a condition of approval, additional Meteoric Water Mobility Procedure sampling, testing and reporting of all waste rock to be mined during the operation (ROD, pp. 22-24), with a particular emphasis on leaching tests of potential backfill material. These tests would, over time, demonstrate what oxyanions concentrations and mobilization would occur during interactions with post-mining pit waters.

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[1] We would note that in Mr. Hahn's letter dated September 27, 1997, he provided no empirical or substantive data or analysis to support his contention that the waste rock would effectively pose no risk to groundwater if used as a backfill material. It was simply his "experience" and "opinion". BLM based its summarized conclusion on the reasoned opinion of the third party EIS contractors geochemical specialist, an additional third party geochemist with Adrian Brown Consultants, and our own internal geochemical expert who provided a thorough analysis of existing literature and test results from the mine site.

Secondly, the ROD left the option open for further determination as to the possibility for backfilling the pits based on continued collection of data and additional modeling and analysis. The requirement for continued long-term collection and analysis of data was intended to provide additional data that could be put into developed models to see if, over time, the outcomes confirmed or denied initial projections in the FEIS. If at some point in time, additional modeling began to identify outcomes differently than the early model runs, then BLM wanted to clearly retain authority to alter conditions of approval and mitigation requirements.

This process for considering alternative future courses of action based on additional long-term data collection and analysis was identified in the FEIS at p. 4-29, Recommended Mitigation. This section provided a discussion of various alternatives to prevent unacceptable impacts to groundwater if additional long-term analysis and modeling predicted unacceptable impacts from post-mining pits lakes to the underlying aquifers in the area. One of the options identified in this section was to consider:

- Partially backfilling the pits with sufficient material to cover the pit lakes. Backfill material would likely come from the waste dumps and should not include any acid generating waste rock, nor compromise the structural integrity of the waste dumps in regard to the encapsulated acid waste rock. Prior to utilizing waste rock for backfill material, testing should be conducted to determine if use of this material would add further to unacceptable groundwater impacts. If this would occur, acceptable material may have to be hauled in from elsewhere. (Emphasis added).

This concept and course of action was further carried into the ROD at p. 4., where it states that:

> The Record of Decision and approval incorporates the recommended mitigation and monitoring as presented in the FEIS.

and again on p. 21 where it states:

> If at any time during monitoring, data and modeling indicate environmental impacts beyond the worst case scenario identified in the FEIS, additional NEPA analysis will be conducted to determine appropriate courses of action.

III. SUMMARY

Our analysis indicates that BLM's projections and concerns with utilizing the mined waste rock for backfill material were accurate and reasonable. Due to the highly complex nature of the geochemical aspects of these issues, the discussion in the FEIS and ROD may have been difficult to grasp. However, based on the data collected, analyzed and presented in the FEIS, and confirmed by the additional data collected and analyzed after IBLA's Stay Order of June 16, 1997, BLM has determined that backfilling would pose a significant risk of metal oxyanion mobilization and transport, with the potential for groundwater contamination. For this reason, along with the other for reasons identified in the ROD, BLM has appropriately rejected the backfilling alternative.

By requiring continual sampling, testing and characterization of the waste rock during the course of mining, and by retaining the option to further consider backfilling at some point in the future with additional assessment and public disclosure pursuant to the National Environmental Policy Act, BLM believes it has established a prudent and responsible course of action.

Prepared by:

A. Lynn Jackson, Project Manager

1-25-99
Date